Claims

1. A process for preparing a purified, essentially virus-safe immunoglobulin preparation, said process comprising the steps of

a) subjecting a starting solution comprising immunoglobulin and polymeric proteins to at least one virus-inactivation step, in which the composition is contacted with caprylic acid to form a precipitate and a supernatant solution comprising dissolved immunoglobulin and polymeric proteins,

b) recovering the supernatant solution,

c) contacting the supernatant solution with at least one ion exchange resin to produce a first effluent comprising immunoglobulin,

d) recovering the first effluent,

e) subjecting the first effluent to nanofiltration on a filter having an average pore size of about 10 to 40 nm to remove any enveloped and non-enveloped viruses and to produce a second effluent,

f) recovering the second effluent, and

g) formulating it to a pharmaceutically acceptable, virus-safe immunoglobulin preparation, which is free from polymeric proteins,

wherein polymeric proteins are removed from the supernatant solution obtained from step b by adding polyethylene glycol to the supernatant solution.

2. The process according to claim 1, wherein step a is carried out by adding caprylic acid to a final concentration of 15 – 60 mmol/l, preferably to 20 – 50 mmol/l.caprylic acid.

3. The process according to claim 2, wherein step a is carried out at a pH of about 4.0 to 5.0.

4. The process according to any of claims 1 to 3, wherein the starting solution is provided by dissolving an immunoglobulin-containing blood fraction in an aqueous solution at a pH of about 4.0 to 5.0, preferably at 4.5 to 5.0.

5. The process according to any of claims 1 to 4, wherein the pH of the supernatant solution of step b is adjusted to a value of about 5.3 or higher.

6. The process according to any of claims 1 to 5, wherein the concentration of the polyethylene glycol is 2 to 4 % by weight of solution.

7. The process according to claim 11 or 12, wherein the supernatant solution contains caprylic acid in a concentration of about 1 to 20 mmol//l.

8. The process according to any of claims 1 to 7, wherein step e is carried out at a pH of 4.2 to 5.0.

9. The process according to any of claims 1 to 8, wherein the starting plasma contains less than 10^4 IU/ml of parvovirus B19 DNA.

10. The process according to any of claims 1 to 9, wherein the starting plasma is obtained from Cohn fraction II+III paste of human plasma.

11. A method of efficaciously filtering immunoglobulin solutions on a nanofilter having a pore size of 10 to 40 nm, which comprises conducting through the filter an immunoglobulin solution, comprising 1 to 25 g/l immunoglobulin, wherein the filtration is carried out at a pH of about 4.2 to 5.0 and wherein the immunoglobulin solution further contains no detectable polymer aggregates, to remove at least 3 log of viruses with particle size of about 20 nm, said immunoglobulin solution being obtained from a crude immunoglobulin solution by

- subjecting the crude immunoglobulin solution to caprylic acid treatment,
- removing protein aggregates and viruses from the immunoglobulin solution by adding polyethylene glycol, and
- subjecting the immunoglobulin solution to anion exchange chromatography

in order to purify the crude immunoglobulin solution and to produce a solution, which is free from detectable amounts of protein aggregates.

12. The method according to claim 11, wherein the immunoglobulin solution contains 2 to 4 wt-% polyethylene glycol.

13. The method according to claim 11, wherein the solution is filtered at a temperature of about 20 to 50 °C and at a pressure difference of about 0.2 to 8 bar.

14. The method according to claim 13, wherein the solution is filtered using a trans-membrane pressure of 0.5 to 5.5 bar.

15. The method according to any of claims 11 to 14, wherein at least 5 kg, preferably at least 7.5 kg, of immunoglobulin is passed through 1 m^2 of filter area with less than 50 % decrease in filter flux.

16. The method according to any of claims 11 to 15, wherein the immunoglobulin solution is filtered on a composite virus-removal filter.

17. The method according to any of claims 11 to 16, wherein filtration is carried out at a pH of about 4.2 to 4.8.